MOBILE RADIO POWER CONTROL DEVICE USING THE COMPARISON OF RETRANSMITTED DATA

BACKGROUND OF THE INVENTION

The present invention generally relates to the field of telecommunications devices and, more particularly, the present invention relates to power control apparatus for use in mobile radio systems.

DESCRIPTION OF THE RELATED ART

Known apparatus for providing closed loop control of transmitted RF power, particularly in the context of CDMA Cellular Mobile Radio, include a means of measuring the received power, a means of comparing the measured power against a threshold, a means of generating a correction signal based on the above comparison, a means of communicating the correction signal from the receiver station to the transmitting station, and a means of controlling the transmission power at the transmitting station in accordance with the correction signal.

The principle is illustrated in FIG. **1**. Here, the transmit power of the mobile station **2** is controlled by the base station **4**. The mobile station **2** transmits at the current power level via a combiner/splitter and antenna **2***a* and has an oscillator **16** and a transmit amplifier **18**. The signal is received at the base station **4** and the power is measured (the diode **6** represents a more complex power measurement operation). The power is then compared against a threshold by a comparator **8**. When the power exceeds the threshold, a "down" signal is generated. When the power is less that the threshold, an "up" signal is generated. These signals are transmitted back to the mobile station via a modulator **10**, through a combiner/splitter and antenna **4***a* over the other half of the duplex channel and received in the mobile station which demodulates the signal in the demodulator **12** and accumulates them (+1 for an "up" signal, −1 for a "down" signal), in the accumulator **14**. The output of the accumulator **14** controls the amplifier **18**, and hence the power directly, according to a logarithmic relationship.

A vital element in the above procedure is the measurement of received signal level. The control of power can only be as accurate as this measurement. This is not a problem for existing systems in which the power control update interval corresponds to several received bits of data and in which the required bit error rate is moderately low, and, therefore, the received signal-to-noise ration is moderately high. The ability to average the received power over several bits of signal gives a significant increase in signal to noise ratio, particularly if this can be done coherently or pseudo-coherently. However, consider the case where the bit rate is very low. In fact, consider the case where the transmitted bit rate is equal to the power control update rate and where the required error rate is moderately high. If a measurement of the received power is made in the receiving station, this can only be performed on the basis of a single bit. The signal-to-noise ratio is perhaps as low as 0 dB on that bit, so measurements will be heavily corrupted by noise.

This situation can arise, unlike that illustrated in FIG. **1**, in the situation where rapid downlink power control is required so that the mobile must transmit power control signalling information to the base station. The transmission of this power control signalling information must, itself, be power controlled. For transmission of packet-type data, it may be a requirement to permit asymmetrical traffic flow so that, on occasions, data traffic will be flowing only on the downlink. In this case, the sole purpose of uplink transmissions is for power control of the downlink and these power control transmissions at the power control signalling rate must themselves be power controlled.

The particular difficulty of this situation is the fact that, when there is no uplink data traffic on a particular link, the interference generated by any control traffic flowing on that uplink should be minimized in order to maximize the total capacity available to other links which are active on their uplinks. If power control traffic is, in fact, the only control traffic on an uplink, then the transmission used to send it must be minimized, exploiting, as much as possible, the very low bit rate. This can only be achieved effectively by exerting fast power control over the power control information transmission.

An object of the present invention is to provide a power control apparatus for use in mobile radio systems wherein power control is exerted in a fast and efficient manner. Other objects and advantages of the present invention will become apparent from the following summary and detailed description of the presently preferred embodiments of the present invention.

SUMMARY OF THE INVENTION

The present invention provides a power controller apparatus for use in mobile radio systems that comprises a first station for transmitting data to and receiving data from a second station, a second station for receiving data from and transmitting data to said first station, said first station comprising a data source, a means for modulating the data source and a means for transmitting data derived from said data source, and a control means for controlling the power of the transmitting means depending on data which is transmitted from said first station to said second station, and then retransmitted back to said first station.

Additional features and advantages of the present invention are described in, and will be apparent from, the detailed description of the presently preferred embodiments and from the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a schematic block diagram of a conventional system.

FIG. **2** illustrates a schematic block diagram of a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

The present invention generally relates to a power control apparatus for use in mobile radio systems. An embodiment of the present invention will now be described with reference to FIG. **2** which is a block diagram of the power control apparatus.

Referring now to FIG. **2**, there is shown a transmitting station **20** and a receiving station **22**. The transmitting station includes a data source **24** connected to a buffer store **26** and to an input of a modulation circuit **28**. The output of the buffer store **26** is connected to a first input of an exclusive OR gate **30**, which, at a second input thereof, receives incoming data from the receiving station via the received data circuit **32**. The output of the exclusive OR gate **30** controls a switch **34** which applies an up-step signal or a down-step signal to the input of an accumulator **36**. An output from the accumulator **36** is connected to control a transmit amplifier **38**.

The receiving station **22** includes a received data circuit **40** which is connected to an input of a modulation circuit **42**, the output of which is connected to a transmit amplifier **44**.

To avoid confusion in the following discussion, the station whose transmit power is being controlled by the invention described herein is referred to as the "transmitting station" (first station) while the station which is receiving the power